



## The medical management of idiopathic chylothorax in a domestic long-haired cat

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**Abstract** — A 3-year-old, spayed female domestic long-hair was evaluated for a 2-week history of progressive tachypnea. Chylothorax was diagnosed through radiographic and pleural fluid evaluation. No primary cause was identified and the cat was managed medically. Thoracocentesis, dietary management, and oral rutin therapy resulted in substantial improvement of this idiopathic condition.

**Résumé** — Protocole médical pour une chatte domestique à poil long ayant un chylothorax idiopathique. Une chatte domestique à poil long, âgée de trois ans et stérilisée est examinée parce qu'elle présente depuis deux semaines une tachypnée progressive. Un chylothorax a été diagnostiqué au moyen de radiographies et d'une évaluation du liquide pleural. Aucune cause primaire n'a pu être déterminée et un traitement médical a été administré. Une thoracocentèse, une diète spéciale et l'administration de rutin par voie orale ont contribué à une amélioration substantielle de cette affection idiopathique.

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A 3-year-old, spayed, female domestic long-hair (5.13 kg) was presented to the Western College of Veterinary Medicine (WCVN) Small Animal Clinic. The cat had a 2-week history of progressive tachypnea. The cat was not lethargic and had no history of exercise intolerance, coughing, or open-mouth breathing. The owner reported that the cat had been kept exclusively indoors since it was acquired as a kitten. There was no history of medical problems and the cat was up-to-date on all vaccinations (including those against feline viral rhinotracheitis, calicivirus infection, panleukopenia, rabies, and feline leukemia). The cat had been placed on a low-fat, high-fiber, reduced calorie diet (Overweight Management, Feline Formula (canned); Purina, St. Louis, Missouri, USA) 6 mo earlier, due to gradual weight gain over the preceding year. Mild weight loss had been observed.

On presentation, the cat was bright and alert, mildly overweight, and tachypneic (96 breaths/min). On physical examination, increased respiratory effort was noted, with decreased lung sounds ventrally and increased bronchovesicular sounds dorsally. Heart sounds were

markedly muffled bilaterally, with a rate of 180 beats/min. No heart murmur or obvious arrhythmia was auscultable. The cat's mucous membranes were pink with a capillary refill time of < 2 s. The rectal temperature was 37.3°C.

The cat was deemed in stable condition following physical examination and was immediately transferred to the radiology department for further evaluation. Right lateral and ventrodorsal thoracic radiographs were taken, revealing a marked bilateral pleural effusion. On right lateral view, the cardiac silhouette and mediastinum were largely obscured by fluid accumulation, as was a large proportion of the cranioventral and middle lung lobes. There was obvious retraction of the lung borders from the dorsal thoracic wall, a distinct rounding of the lung borders, and moderate atelectasis. The ventrodorsal view displayed prominent interlobar fissures, accompanied by a distinct separation of the lung borders from the thoracic wall.

Following radiography, the cat became uncooperative, so it was anesthetized with propofol (Rapinivet; Schering Plough, Pointe Claire, Quebec), 15 mg, IV. The cat was intubated and placed on sevoflurane (SevoFlo; Abbott Laboratories, Illinois, USA) with 100% oxygen. Bilateral thoracocentesis was performed using aseptic technique and a 22-gauge butterfly catheter inserted into the 8th intercostal space, just ventral to the costochondral junction. A volume of 160 mL (approximately 80 mL per side) of opaque, milky-white pleural fluid was removed and submitted to the WCVN Clinical Pathology Department for further analysis.

Following thoracocentesis, the cat was radiographed again to assess the results of the drainage. Fluid was still noted cranioventrally on a lateral view, although great

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**Table 1. Triglyceride and cholesterol analysis of pleural fluid and serum in a cat with idiopathic chylothorax**

Test performed	Result (mmol/L)	Normal values (mmol/L)
Fluid triglycerides	30.14	—
Fluid cholesterol	1.9	—
Serum triglycerides	1.9	0.26–1.07
Serum cholesterol	3.24	1.62–4.32

improvement was evident. The heart could now be visualized, although the cranial border was still obscured. There was no evidence of cardiac enlargement or shift in the positioning of the heart. Mild to moderate atelectasis persisted, as did the rounded lung borders. An electrocardiogram and echocardiogram were requested. They revealed no cardiac abnormalities. Ultrasonography of the chest established that the thorax still contained some fluid, but there was no evidence of a precardiac or pericardiac mass. With it being atelectic, the lung was difficult to assess on ultrasonography, although no consolidation was observed.

A blood sample was collected from the jugular vein and submitted for a complete blood cell (CBC) count (Abbott Cell-Dyn 3500R; Abbott Laboratories) and biochemical profile (Roche Hitachi 912; Roche Hitachi, Montreal, Quebec). In addition, a feline leukemia virus (FeLV) and feline immunodeficiency virus (FIV) enzyme-linked immunosorbent assay (IDEXX SNAP ELISA; IDEXX Laboratories, Westbrook, Maine, USA) was performed. Urine was collected via cystocentesis. The CBC count revealed a mild lymphopenia, which was attributed to stress. The biochemical profile was unremarkable. The FeLV/FIV test was negative. Urinalysis revealed no abnormalities. Both direct smear and cytocentrifuge preparations were made from the pleural fluid. These displayed similar findings. The fluid had a nucleated cell count of ( $39.3 \times 10^9/L$ ) with no evidence of red blood cells. The total protein and specific gravity were not determined. Cytologic analysis demonstrated a predominance of small (5 to 10  $\mu m$  in diameter) lymphocytes. Many of these cells were slightly irregular on their nuclear borders, which was attributed to a prolonged residence in the fluid. There were also occasional macrophages and neutrophils, possibly indicating chronicity. These pleural fluid characteristics were suggestive of a chylous effusion, although a thymoma or mediastinal lymphosarcoma could not be excluded at this time.

Pleural fluid triglyceride and cholesterol concentrations were determined to establish whether a chylous fluid was present. These values were compared with normal blood serum values (Table 1).

The pleural fluid cholesterol to triglyceride ratio (C:T) was found to be 0.06. This is important because a value less than 1.0 confirms that an effusion is chylous (6). Other criteria for identifying chylous fluid include a combination of the gross appearance of the fluid, its microscopic appearance (containing chylomicrons), the effect of centrifugation, and the ability of the fluid to clear when ether is added (1). Cholesterol concentration, triglyceride concentration, and C:T ratios of pleural fluid are quantitative tests that can be used to help in confirming a diagnosis of chylothorax. These tests should

not replace cytologic examination and examination for chylomicrons; instead they should be used to provide quantitative information to help in identifying chylous effusions. The pleural fluid triglyceride concentration will be significantly higher and the C:T ratio should be significantly lower in chylous effusions compared with nonchylous effusions (6).

A diagnosis of idiopathic chylothorax was made. This was based on the radiographic evidence of a pleural effusion, plus the appearance and analysis of the pleural fluid itself. In order to be “idiopathic,” diagnostic measures must have ruled out known underlying causes of the disease (9).

Chylothorax is a condition where chyle, triglyceride-rich lymphatic fluid, accumulates within the pleural space. Chyle originates within the intestinal lymphatics, where it courses cranially to drain into the cisterna chyli and thoracic duct. The thoracic duct then empties the lymphatic content into the venous system in the cranial thorax of the animal (1). Any disease process that results in the reduction or prevention of chyle flow into the thoracic duct or cisterna, or that decreases the amount of chyle emptying into the venous system, may potentially increase the pressure within the lymphatics and lead to chylothorax. Regardless of the precise mechanism, the condition has been described as a failure in the balance between chyle production and clearance (3). The reason for chyle accumulation within the thoracic cavity of cats often remains a mystery, despite extensive diagnostic efforts.

There are many primary causes of chylothorax (2,3). These include cranial mediastinal masses (thymoma, mediastinal lymphosarcoma), heart disease (cardiomyopathy, pericardial effusion, heartworm infection, foreign objects, tetralogy of Fallot, tricuspid dysplasia), fungal granulomas, systemic lymphangiectasia, venous thrombi, diaphragmatic hernias, trauma, and congenital abnormalities of the thoracic duct. Ultrasonography of the heart and thorax rules out cardiomyopathy and cranial mediastinal masses. A CBC count, serum biochemical profile, and urinalysis are general health indicators. Testing for FeLV and FIV should be performed in all cats with chylothorax, because both of these conditions may lead to various syndromes, such as thoracic neoplasia, which increase the animal's risk of chylothorax (7). Thoracic radiographs may help in detecting a thoracic mass, potential diaphragmatic hernia, or any changes in the heart or lungs. In regions where heartworm, *Dirofilaria immitis*, is a problem, antigen and antibody tests should always be performed. However, in cats, false negatives can be problematic due to low numbers of parasites (5).

The medical management of this cat began with thoracocentesis, which, in this case, was both diagnostic and therapeutic. The drainage of a large volume of pleural fluid relieved the animal's respiratory distress, lowered her respiratory rate, and allowed greater expansion of the thoracic wall. Her respiratory rate following recovery from anesthetic had dramatically reduced from 96 to 16 breaths/min. There was a marked improvement in the audible field during auscultation of the heart and lungs, although increased lung sounds were still evident over the dorsal region. Upon discharge of the cat, the owner

was informed that repeated thoracocentesis is frequently necessary with this condition. The cat was scheduled to return the following week for reexamination. This visit was to be scheduled sooner should the cat show any signs of tachypnea or dyspnea.

Rutin, a flavone benzo- $\gamma$ -pyrone plant fruit extract (bioflavonoid) from the Brazilian Fava D'Anta (*Dimorphandra*) tree (10), was instituted at a dose of 50 mg/kg BW, PO, q8h as a means of medical management. Rutin is classified as a nutraceutical and is available at health food stores. It has been used successfully in humans for the treatment of lymphedema (11), and it is hoped that this drug may also prove useful in decreasing pleural effusion in cats with chylothorax. The proposed mechanisms of action of rutin include reducing leakage from blood vessels, increasing protein removal by lymphatic vessels, increasing the macrophage phagocytosis of chyle, increasing tissue macrophage numbers, and increasing proteolysis and removal of protein from tissues (3). Preliminary findings with rutin suggests that greater than 25% of animals treated with this product have a complete resolution of their effusion 2 mo after the initiation of therapy (8). Rutin use in 4 cats with idiopathic chylothorax resulted in clinical improvement in 3 of the 4 (10). Two of the cats had complete resolution of their effusions shortly after beginning rutin therapy. One cat's condition worsened when rutin administration ceased, only to improve again when the therapy was reinstituted. The cat presenting to the WCVN showed considerable improvement when treated with rutin. Radiographs taken 1 and 4 wk after initiating rutin therapy showed rapid and substantial improvement in the amount of chyle within the thoracic cavity. The possibility, however, of a spontaneous resolution irrespective of the rutin administration must still be considered. Although this information appears promising and quite supportive of rutin in managing cats with chylothorax medically, the evidence is still anecdotal and further research is necessary. The current recommended dose of rutin is 50 to 100 mg/kg BW, PO, q8h (10). So far, in humans, gastric irritation is its only recognized adverse effect (11). The potential complications in cats have yet to be investigated.

The owner was instructed to maintain the cat on its current low fat diet. The dietary management of a cat with chylothorax initially involves meeting the animals' caloric needs. These animals are often in a state of negative energy balance, as they are losing important nutrients into their thoracic cavity and are frequently anorexic (1). Once the animal is eating, an important step in limiting this disease is in providing it with a quality low fat diet. Feeding a low-fat diet may decrease the fat within the pleural effusion; this, in turn, may improve fluid reabsorption from the thoracic cavity and limit chyle accumulation (2).

The potential for surgical treatment of the cat's condition was mentioned but not recommended to the owner at this time. Recent thinking supports surgical intervention for animals with idiopathic chylothorax for which medical management has become impractical or has already failed (3). This means that thoracocentesis becomes necessary more often than once a week and that medical management is not succeeding in reducing the amount of effusion. Surgery may be instituted for these

select cases despite some controversy surrounding the success and efficacy of the various surgical techniques. The surgical options currently available for animals with idiopathic chylothorax include mesenteric lymphangiography and thoracic duct ligation, passive pleuroperitoneal shunting, active pleuroperitoneal or pleurovenous shunting, pleurodesis, subtotal pericardectomy, and omentalization (12).

The follow-up examination and radiographs were performed 1 wk after the initial presentation. The owner noted that the cat had been doing very well at home, with no episodes of tachypnea or visible exercise intolerance. The cat was eating and drinking well, and behaving normally. Radiographs revealed some remaining fluid in the thorax, although it was distributed differently. The lungs were still mildly atelectic, with the caudal lung lobes being retracted from the dorsal body wall. The heart and cranial mediastinum displayed no abnormalities. Radiographs repeated 2 wk later showed continuing improvement in lung expansion and mild resolution of the effusion. A physical examination and radiographs taken 10 mo later showed a small amount of persistent pleural fluid, accompanied by mild atelectasis and possible mild fibrotic change to the caudal lung borders. The cat had remained on rutin therapy and no further pleural drainage had been necessary.

Although the cat described in this case was a domestic long-hair of no specific breed, chylothorax may be more frequent in purebreds, such as the Siamese or Abyssinian (5). This latter study showed no gender predisposition for the disease, but there was a tendency for it to affect older cats. This age association was thought to be related to older cats developing the disease secondary to a neoplastic process. Our cat was a young 3-year-old, with no evidence of neoplasia.

The most common clinical signs of chylothorax are dyspnea, tachypnea, coughing, weight loss, and anorexia (6). A retrospective study on 37 cats with chylothorax listed the common findings on examination as follows: dyspnea (84%), muffled heart sounds (41%), tachypnea (30% respiratory rate > 60 breaths/min), increased bronchovesicular sounds over the aerated lung fields (46%), tachycardia (16% with heart rate > 200 beats/min) and depression (32%). Most cats in this study had normal temperatures and adequate hydration (5), as was the situation with the case presented here. Of the study animals described above, 49% of these cats demonstrated clinical signs for 1 to 4 wk prior to presentation. Again, our cat was exhibiting an elevated respiratory rate for approximately 2 wk prior to being brought to the WCVN.

The specific approach to treating chylothorax is controversial, but it should address the needs of each individual. Treatment must first address the primary cause. If none is found, either medical or surgical management is followed. There are divergent opinions regarding these options. Clients should be informed that with the idiopathic form of this disease, no treatment completely stops the effusion in all animals. However, the condition may resolve spontaneously in some animals after several weeks or months (8).

The initial medical management must address respiratory compromise by draining fluid from the thoracic cavity. Thoracocentesis immediately allows the lungs to

expand and reduces pleural irritation (4). Initial thoracocentesis is usually performed with a needle, although a chest tube may be required (8). Traditionally, management of idiopathic chylothorax via frequent thoracocentesis plus diet change has offered only a 20% resolution rate of the disease (5). Fortunately, this case proved to be one of the successful treatments.

A chylothorax left untreated, or which cannot be controlled through medical or surgical management, may result in numerous adversities for the patient. Repeated drainage of a chylothorax accompanied by the ongoing fluid loss into the thorax will often lead to a dehydrated animal (3). In addition, lipids, proteins, and fat-soluble vitamins are lost, which may result in weight loss and emaciation due to caloric and nutrient depletion. Other serious consequences of ongoing chyle loss are electrolyte imbalances (hyponatremia, hyperkalemia), possible infections secondary to a compromised immune system, and lymphopenia (4). Lymphopenia is considered to be the most common hematological abnormality occurring with chylothorax (5). It was the only abnormality noted on the hematologic examination of our cat, likely related partially to a stress response, in addition to some loss into the thoracic cavity.

Chronic chylothorax in cats can result in life-threatening fibrosing pleuritis, a reportedly rare diffuse thickening of the pleura in response to chronic fluid exudation. Fibrosing pleuritis can even occur after successful management of chylothorax, resulting in a restrictive pleuritis and the inability to properly expand the lungs (5). Follow-up radiographs 10 mo after the initial presentation did reveal an area of possible fibrosis and limited lung expansion in our patient; however, the lungs appeared to be inflating normally for the most part, thus minimizing the severity of this animal's prognosis.

The current prognosis for cats with chylothorax is usually described as guarded to poor (7). The disease remains complicated with a poorly understood etiology. More research is certainly needed to better comprehend the pathophysiology and most beneficial treatment of this disease. The future of this case appears promising at

present time but remains ambiguous. It is difficult to describe a specific treatment as successful based on anecdotal reports, or reports lacking long-term follow-up. Caution should therefore be used when discussing the prognosis of the animal with the owners. Only time will tell whether this cat will continue to thrive on medical management alone, or whether some alternative course of action may later be required.

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